



πλ²

PI L SQUARED

- MIDI powered, duophonic Synth
- square wave synthesis
- digital & analog filter

User Manual
From Firmware Update V2.0

πλογτεc Ploytec GmbH – πλ² (PL2) Synthesizer - English Manual - Version 2.0, last revised: August 2014

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Safety Instructions



Please only connect analogue audio connections when switched off, in order to protect the speaker membranes and your hearing against sudden sound level peaks. Connecting the device to the USB port of your computer may also cause a noise—please turn down the volume of your playback system accordingly.

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Introduction

We are pleased that you have chosen a Ploytec $\pi\lambda^2$ (*Pi Lambda squared 2* or simply PL2) synthesizer system for your musical endeavors and would like to congratulate you on your decision. We're convinced this innovative development will prove extremely useful to you in the coming years and, above all, provide you with a great deal of entertainment.

We hope you find this manual both informative and entertaining to read, and hope you find lots of pleasure in the Ploytec PL2 synthesizer system.

... Your Ploytec-Team!

Important Notes about Power Supply



The PL2 can generally be powered from the MIDI port without the need for a power adapter. You should ensure, however, that the external MIDI device connected to this port can provide the required current. If this isn't the case you can use a common 5 Volt DC (100mA min.) USB power adapter (e.g. as commonly used for mobile phones) and connect to the PL2 USB Micro-B port. Of course a standard PC or HUB USB port can provide the needed power as well.

Power supply adapter and USB cables are not part of the scope of delivery.

At a Glance - New Features with Firmware V2.0

- Now you can choose the MIDI channel and even the Omni mode (receive on all 16 channels) is available.
- The range of notes can be limited by min. or max. values.
- The startup program can be pre-selected within the editor software.
- If the parameter [Digital Filter Cutoff] is set to zero the key velocity will automatically control the filter cutoff.
- The LFO modulation effects the filter with higher speed if the parameter [Note Priority] is set **On**. Especially for higher played notes the new LFO speed results in an interesting sound impression.
- Fine-Tuning is possible now. This is done by moving and holding the pitchbend wheel and simultaneously switching the program (using the MIDI program change message) to set the new main pitch. Simply move the pitchbend wheel to the min. or max. position to reset the pitch to its standard value.
- MIDI Active Sensing is supported..
- MIDI Polyphonic Aftertouch is supported. If your master keyboard or host application sends aftertouch information for each note these will effect the volume (starting from the volume which is set by the velocity).
- Shorter program switch-over times are realized.
- A new Second Mode expands with three new waveforms and with the Bassdrum Mode. By using the MIDI-controller #3 (new) you can switch between the Normal and the Second Mode.
- Four new preset programs are located on the program positions 4 and 22 to 24.

Overview of Technology

Despite its small housing the PL2 is a complete duophonic mono synthesizer. The PL2 generates an enormous variety of sounds with the help of two square wave (pulse) oscillators which can be interconnected in variable and innovative ways - these are fun to experiment with. Not only the classic waveforms such as saw-, sine- or pulse-waves will be simulated, rather newly and interesting sounds - from warm to destructive - are also generated.

The PL2 receives its data via a selectable MIDI channel and all setting parameters can be edited by MIDI controller commandos. Up to 32 of your own self-programmed sounds can be stored in the user memory area. In addition, further 32 factory sounds are located within a fixed memory area which provides ideal starting material to experiment with.

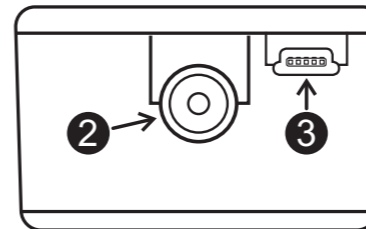
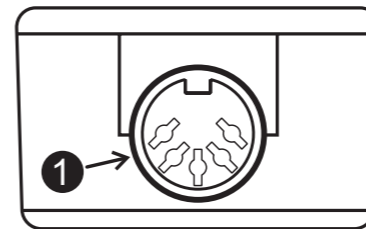
Generally, the PL2 follows the principle of subtractive synthesis in which the waveform (generated by the oscillators) first runs through a wide range adjustable digital filter stage (low- high- and band-pass) to edit the frequency spectrum and/or amplify the resonance area if desired. After the digital filter an additional analog low-pass filter follows which particularly ensures the necessary warmth especially for destructive- and digital-like sounds.

Wait, there's more: a dedicated analog saturation stage at the output provides dynamic compression and therefore a respectable bass punch is created.

Of course the PL2 includes several additional options in terms of sound and playing manipulation like LFO modulation, PWM, ADSR envelope and various play modes. Another interesting detail: LFO- and envelope-speed synchronise automatically to an external applied MIDI clock - whereby the PL2 perfectly adjust to your song tempo.

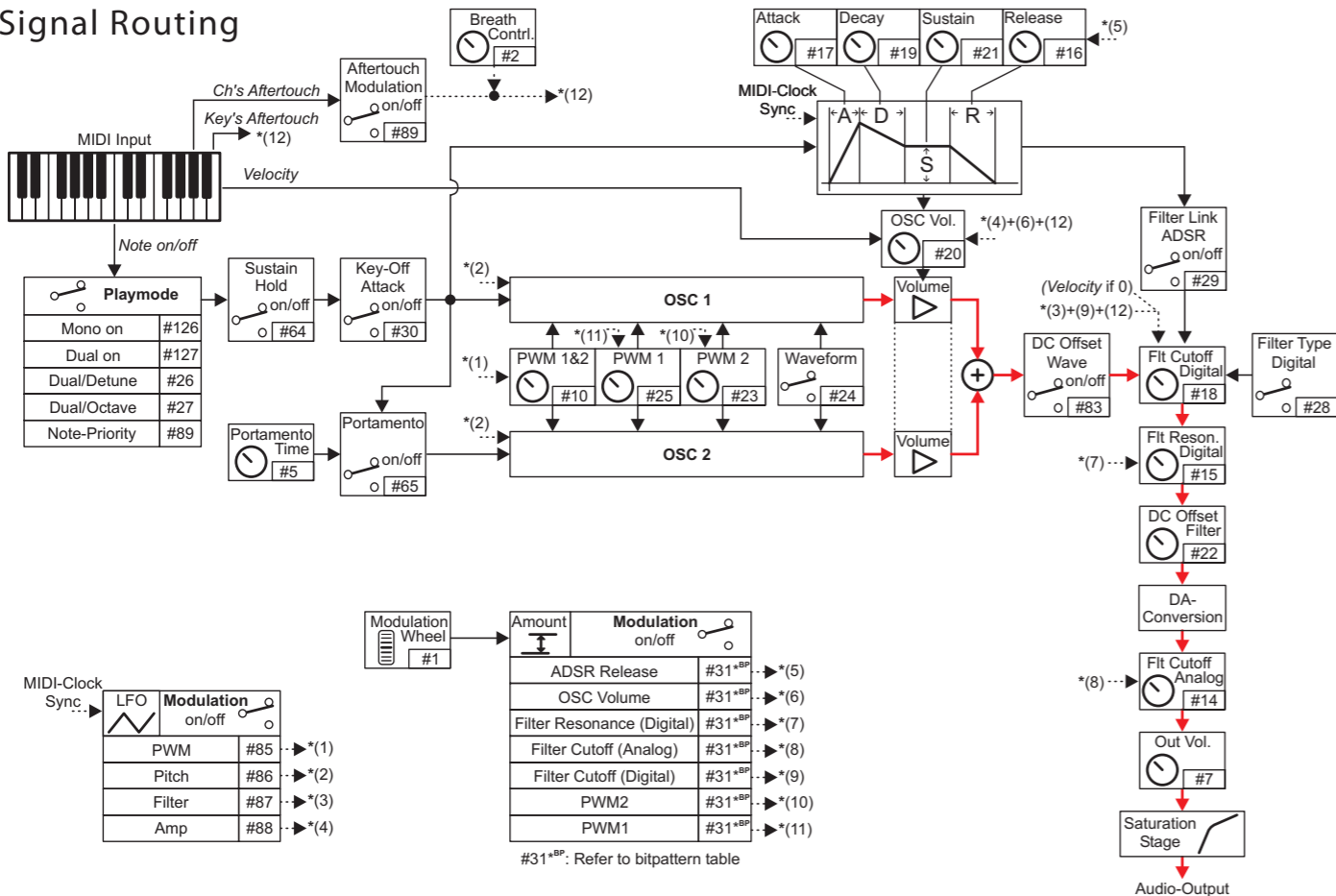
For convenient and extended operation a software editor is available for Mac and PC. In addition, future PL2 synthesizer extensions or new features can be integrated by updating the firmware.

Connectivity



- 1. MIDI jack.** With the MIDI input jack it is possible to connect external MIDI peripheral (e.g. keyboards, PC MIDI interfaces, etc.) Usually the PL2 will be powered through this jack also.
- 2. Audio output jack.** The output jack is designed to be connected to unbalanced RCA (cinch) lines. If possible only use high quality RCA audio cables.
- 3. Micro-B USB jack.** In most cases the PL2 synthesizer will be powered through the MIDI jack and no external power supply will be required. You can connect a separate power supply (not included) or USB PC/HUB port to this jack, if necessary. Also refer to **“Important Notes about Power Supply”** .

Signal Routing



Play Modes

Instruction	Status Byte	Data Byte	Meaning
Mono On	126	0-127	Only oscillator 1 is active.
Dual On	127	0	Both oscillators (having equal phase positions) are active as soon as two notes are played at the same time. If more than two notes are played MIDI controller #89 sets the priority.
Dual/Detune	26 or 77	On: 0-63 Off: 64-127	Both oscillators have unequal phase positions. [Off] will switch back to the mono mode.
Dual/Octave	27 or 78	On: 0-63 Off: 64-127	Both oscillators have equal phase positions. Oscillator 2 is pitched one octave lower than oscillator 1. [Off] will switch back to the mono mode.
Note Priority	89	On: 0-63 Off: 64-127	In dual modes the values up to 63 leading to play the both highest notes. The values above 63 leading to play the both lowest notes and one octave lower . Note: controller #89 switches [Aftertouch] also.
Aftertouch	89	On: 32-127 Off: 0-32	With values from 32 the aftertouch information will control the digital filter cutoff. Note: controller #89 switches [Note Priority] also.
Breath Control	2	0-127	Like for [Aftertouch] breath control controls the filter cutoff. Note that [Breath Control] and [Aftertouch] will overwrite each other.
Sustain Hold	64	On: 64-127 Off: 0-63	Hold function. If [On] is selected note-off commands are no longer processed. A played note holds a fixed level - which is set by controller #21 ([Sustain] of ADSR envelope) - until new notes occurs. This depends on the particular mono-/ dual-mode.

All values use decimal notation

Instruction	Status Byte	Data Byte	Meaning
Key-Off Attack	30 or 81	On: 64-127 Off: 0-63	If [On] is set note off commands will generate ADSR envelope re-triggering. Interesting for bassy and percussive sounds.
Portamento	65	On: 64-127 Off: 0-63	Glide. A new played note will slide from the previous to the new target pitch.
Portamento Time	5	0-127	If [Portamento] is selected this parameter controls the speed at which an oscillator moves to a new pitch.
All Sound Off	120	0	Silence all notes currently sounding.
All Notes Off	123	0	Turns off all voices. A note-off message will address each note to stop hanging sounds if necessary.
Second Mode	3	On: 01 Off: 00	The Second Mode expands the PL2 with three additional waveforms and a special Bassdrum Mode.

All values use decimal notation

Envelope

The envelope speed will synchronise automatically to an externally applied MIDI clock.

Instruction	Status Byte	Data Byte	Meaning
ADSR Attack	17 or 73	0-127	Rise time of the ADSR envelope generator.
ADSR Decay	19 or 91	0-127	Decay time of the ADSR envelope generator.
ADSR Sustain	21 or 93	0-127	Hold level of the ADSR envelope generator.
ADSR Release	16 or 72	0-127	Release time of the ADSR envelope generator.

All values use decimal notation

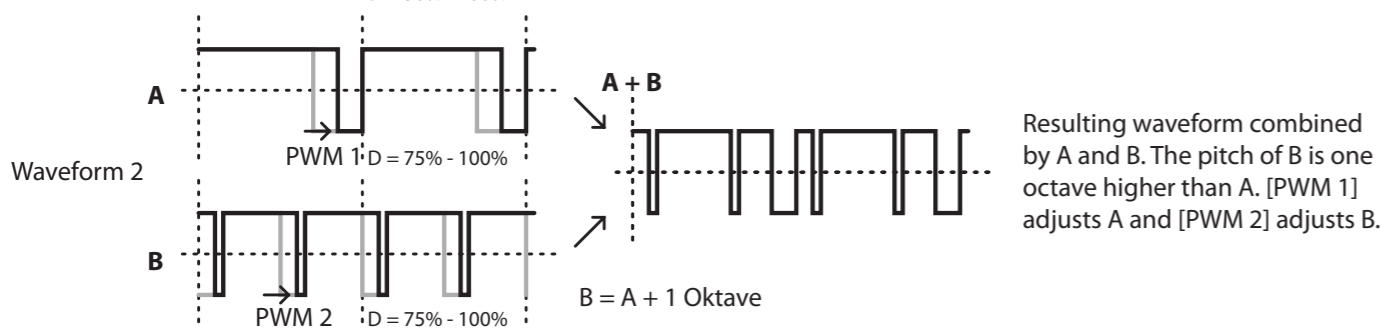
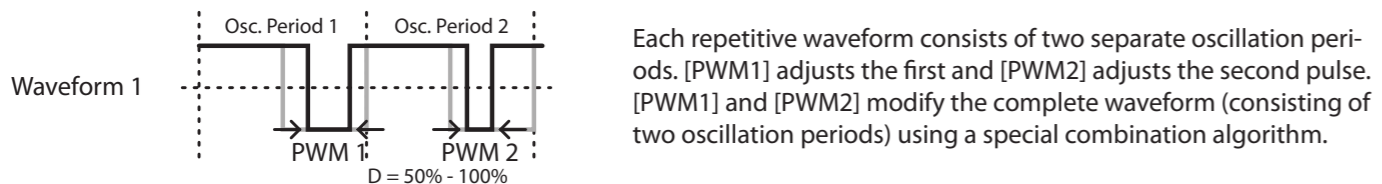
Oscillators

Instruction	Status Byte	Daten Byte	Meaning
PWM 1	25 or 76	0-127	Pulse width modulation 1, will be overwritten by [PWM 1&2].
PWM 2	23 or 95	0-127	Pulse width modulation 2, will be overwritten by [PWM 1&2].
PWM 1&2	10	0-127	Pulse width modulation 1&2, controls in absolute and not in relative terms.
OSC Volume (Pre Filter Volume)	20 or 92	0-127	Oscillator maximal level. The velocity and the envelope generator (ADSR) modulate the volume to a maximum level set here.
DC Offset Wave	83	On: 64-127 Off: 0-63	Bitshifter. The waveform will be shifted upwards by a fixed level set here. As soon the upper limit is reached the truncated part will be inserted at the lower limit again. Thereby distorted and destructive sounds can be generated.

All values use decimal notation

Instruction	Status Byte	Data Byte	Meaning
Waveform	24 or 75	1: 0-31 2: 32-63 3: 64-95 4: 96-127	1: Oscillation period 1 and 2 have the same pitch. 2: The pitch of oscillation period 2 is one octave higher than period 1. 3 and 4: Complex square wave forms - [PWM 1] adjusts the lower half wave, [PWM 2] adjusts the upper half wave.

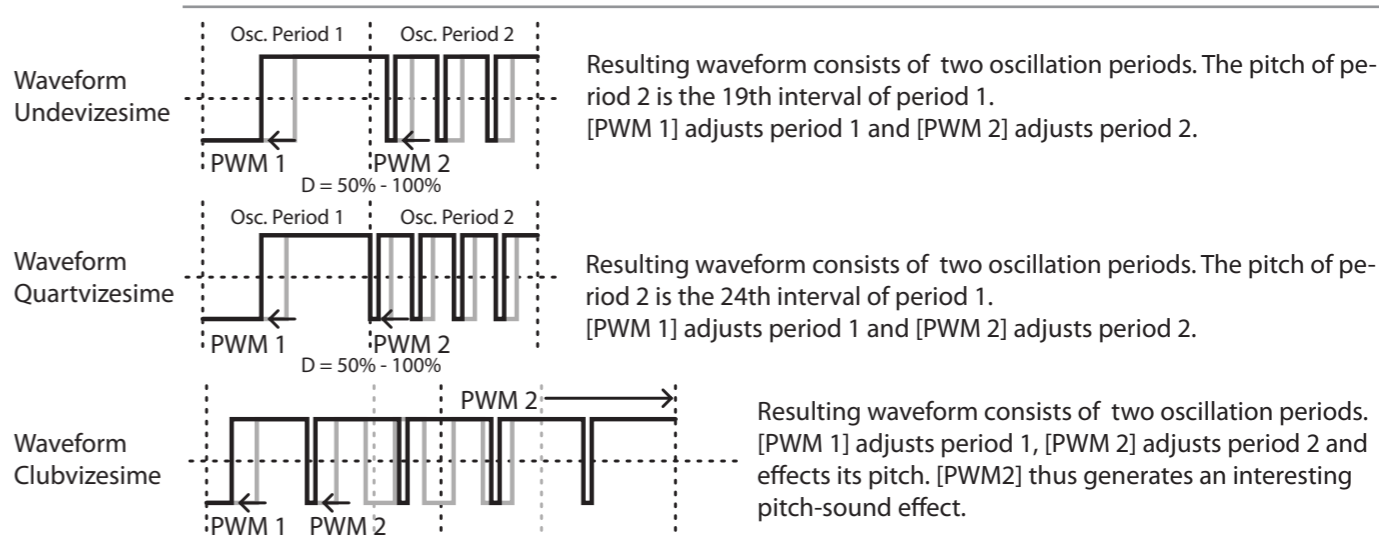
All values use decimal notation



Instruction	Status Byte	Data Byte	Meaning
Waveform	24 or 75	1: 0-31 2: 32-63 3: 64-95 4: 96-127	1: Bassdrum Mode 2: Undevizesime 3: Quartvizesime 4: Clubvizesime.

All values use decimal notation

The lower part of the keyboard (to MIDI note F3) plays the bassdrum sound. Notes above (from F#3) generate a noise sound. The played pitch effects the bassdrum sound but doesn't effect the noise.



Bassdrum Mode controller allocation:

- [PWM1]: Bassdrum Timbre
- [PWM2]: Bassdrum Kick Attack
- [PWM1&2]: Bassdrum Timbre & Kick-Attack
- [DC Offset Wave]: Bassdrum Release Sound
- [Portamento Time]: Bassdrum Release Time

The digital filter, the ADSR envelope and [OSC Volume] only control the noise. [Out Volume] and [DC Offset Filter] control the kick and the noise. Some controllers are not used in Bassdrum Mode.

Filter

Instruction	Status Byte	Daten Byte	Meaning
Filter Cutoff	18 or 74	0-127	Adjusts the digital filter cutoff frequency.
Filter Resonance	15 or 71	0-127	Amplifies the digital filter resonance area.
DC Offset (Post Filter)	22 or 94	0-127	Bitshifter. The waveform after the digital filter can be shifted upwards by a level set here. As soon the upper limit is reached the truncated part will be inserted at the lower limit again. Thereby experimental sounding tones can be generated here once more.
Filter Type	28 or 79	LP: 0-63 BP: 64-95 HP: 96-127	LP = low pass filter BP = band pass filter HP = high pass filter
Filter Cutoff (Analog)	14 or 70	0-127	After the digital filter and DA conversion, an additional analog low-pass filter follows. The analog filter cutoff frequency is adjusted here. Note : this parameter isn't useful for dynamic control because disturbing noises can occur while playing notes and changing this parameter at the same time.
Filter Link ADSR	29 or 80	On: 64-127 Off: 0-63	The amplifier envelope can control the digital filter cutoff frequency if linked. [On] will activate the link.

All values use decimal notation

LFO

The integrated low frequency oscillator (LFO) can effect up to five destination parameters. The LFO speed will synchronise automatically to an externally applied MIDI clock.

Instruction	Status Byte	Data Byte	Meaning
PWM	85	On: 64-127 Off: 0-63	Controls the parameter [PWM 1&2].
Pitch	86	On: 64-127 Off: 0-63	Controls the main pitch.
Filter	87	On: 64-127 Off: 0-63	Controls the parameter [Filter Cutoff Digital].
Amp	88	On: 64-127 Off: 0-63	Controls the parameter [OSC Volume].

All values use decimal notation

Modulation

Instruction	Status Byte	Data Byte	Meaning
Modulation Wheel Mode	31 or 82	0-127 Bitpattern	Up to seven destination parameters can be effected by the modulation wheel: [ADRS Release], [OSC Volume], [Filter Resonance], [Filter Cutoff Analog], [PWM 1] and [PWM 2] can be assigned in form of a bitpattern to any possible combination. The desired combination can be taken from the "Bitpattern" table chart.

All values use decimal notation

Modulation Wheel Bitpattern

Daten-Byte	ADSR Release	OSC Volume	Filter Reson. (Digital)	Filter Cutoff (Analog)	Filter Cutoff (Digital)	PWM 2	PWM 1	Daten-Byte	ADSR Release	OSC Volume	Filter Reson. (Digital)	Filter Cutoff (Analog)	Filter Cutoff (Digital)	PWM 2	PWM 1
00								32		✓					
01							✓	33		✓					✓
02						✓		34		✓				✓	
03						✓	✓	35		✓				✓	✓
04					✓			36		✓			✓		
05					✓		✓	37		✓			✓	✓	
06					✓	✓		38		✓			✓	✓	
07					✓	✓	✓	39		✓			✓	✓	
08				✓				40		✓		✓			
09				✓			✓	41		✓		✓			✓
10				✓		✓		42		✓		✓		✓	
11				✓		✓	✓	43		✓		✓		✓	✓
12				✓	✓			44		✓		✓	✓		
13				✓	✓		✓	45		✓		✓	✓		✓
14				✓	✓	✓		46		✓		✓	✓	✓	
15				✓	✓	✓	✓	47		✓		✓	✓	✓	✓
16			✓					48		✓	✓				
17			✓				✓	49		✓	✓				✓
18			✓			✓		50		✓	✓		✓		
19			✓			✓	✓	51		✓	✓		✓	✓	
20			✓		✓			52		✓	✓		✓		
21			✓		✓		✓	53		✓	✓		✓		✓
22			✓		✓	✓		54		✓	✓		✓	✓	
23			✓		✓	✓	✓	55		✓	✓		✓	✓	✓
24			✓	✓				56		✓	✓	✓			
25			✓	✓			✓	57		✓	✓	✓			✓
26			✓	✓		✓		58		✓	✓	✓		✓	
27			✓	✓		✓	✓	59		✓	✓	✓		✓	✓
28			✓	✓	✓			60		✓	✓	✓	✓		
29			✓	✓	✓		✓	61		✓	✓	✓	✓		✓
30			✓	✓	✓	✓		62		✓	✓	✓	✓	✓	
31			✓	✓	✓	✓	✓	63		✓	✓	✓	✓	✓	✓

Modulation Wheel Bitpattern

Daten-Byte	ADSR Release	OSC Volume	Filter Reson. (Digital)	Filter Cutoff (Analog)	Filter Cutoff (Digital)	PWM 2	PWM 1	Daten-Byte	ADSR Release	OSC Volume	Filter Reson. (Digital)	Filter Cutoff (Analog)	Filter Cutoff (Digital)	PWM 2	PWM 1
64	✓							96	✓	✓					
65	✓						✓	97	✓	✓					✓
66	✓					✓		98	✓	✓				✓	
67	✓					✓	✓	99	✓	✓				✓	✓
68	✓				✓			100	✓	✓			✓		
69	✓				✓		✓	101	✓	✓			✓		✓
70	✓				✓	✓		102	✓	✓			✓	✓	
71	✓				✓	✓	✓	103	✓	✓			✓	✓	✓
72	✓			✓				104	✓	✓		✓			
73	✓			✓			✓	105	✓	✓		✓			✓
74	✓			✓		✓		106	✓	✓		✓		✓	
75	✓			✓		✓	✓	107	✓	✓		✓		✓	✓
76	✓			✓	✓			108	✓	✓		✓	✓		
77	✓			✓	✓		✓	109	✓	✓		✓	✓		✓
78	✓			✓	✓	✓		110	✓	✓		✓	✓	✓	
79	✓			✓	✓	✓	✓	111	✓	✓		✓	✓	✓	✓
80	✓		✓					112	✓	✓	✓				
81	✓		✓				✓	113	✓	✓	✓				✓
82	✓		✓			✓		114	✓	✓	✓		✓		
83	✓		✓			✓	✓	115	✓	✓	✓		✓	✓	
84	✓		✓		✓			116	✓	✓	✓		✓		
85	✓		✓		✓		✓	117	✓	✓	✓		✓		✓
86	✓		✓		✓	✓		118	✓	✓	✓		✓	✓	
87	✓		✓		✓	✓	✓	119	✓	✓	✓		✓	✓	✓
88	✓		✓	✓				120	✓	✓	✓	✓			
89	✓		✓	✓			✓	121	✓	✓	✓	✓			✓
90	✓		✓	✓		✓		122	✓	✓	✓	✓		✓	
91	✓		✓	✓		✓	✓	123	✓	✓	✓	✓		✓	✓
92	✓		✓	✓	✓			124	✓	✓	✓	✓	✓		
93	✓		✓	✓	✓		✓	125	✓	✓	✓	✓	✓		✓
94	✓		✓	✓	✓	✓		126	✓	✓	✓	✓	✓	✓	
95	✓		✓	✓	✓	✓	✓	127	✓	✓	✓	✓	✓	✓	✓

Output

Instruction	Status Byte	Data Byte	Meaning
Out Volume	7	0-127	The output includes an analog volume control which is linked commonly with the following saturation stage. The output signal therefore gets rising compression by rising output level.

All values use decimal notation

Program Memory

The PL2 program memory includes 64 positions which can be selected by standard MIDI program change messages. The first 32 programs include the factory sounds which are fixed and cannot be overwritten. The memory space from 33 to 64 is the user area. All parameter changes made here will be stored automatically as soon as you switch (via MIDI program change) to another program. Upon delivery the factory sounds can be found additionally at program position 33-64 and therefore provides ideal starting material to experiment with. The program numbers 65-128 include random sounds.

Factory Sounds * new with Firmware V2.0 - ROM only

Progr.	Name
1	Upright Bass
2	Analog Synth
3	Lord
4	Cempilo*
5	Analog Strings
6	Summer Bass
7	Will You
8	Berlin 61

Progr.	Name
9	Main Bass
10	On Air
11	Black Roses
12	Poison
13	5th down
14	Dub Bass
15	Charles
16	Wesley

Progr.	Name
17	Analog Bass
18	Signals
19	Mr. Finger
20	Dead Cat
21	Titanium
22	Neon Wobble*
23	PR-L08*
24	PR-L09*

Progr.	Name
25	Geiger
26	Metropolis
27	Vettel
28	Analog Pad
29	Lukas
30	Transformator
31	Smacker
32	Electric Moskito

Appendix

Declaration of Conformity

We:

Ploytec GmbH • Fahrnauerstr. 64 • 79650 Schopfheim

hereby declare that the product

Ploytec PL2 Synthesizer ,

to which this declaration refers is in compliance with the following standards or standardising documents:

- EN 55022: 1998+Corrigendum July 2003+A1:2000+ Corrigendum April 2003+A2:2003
- EN 55024: 1998+A1:2001+A2:2003

to which this declaration refers is in compliance with the following standards or standardising documents:

residential, business and commercial environments and small-company environments.

Technical Data:

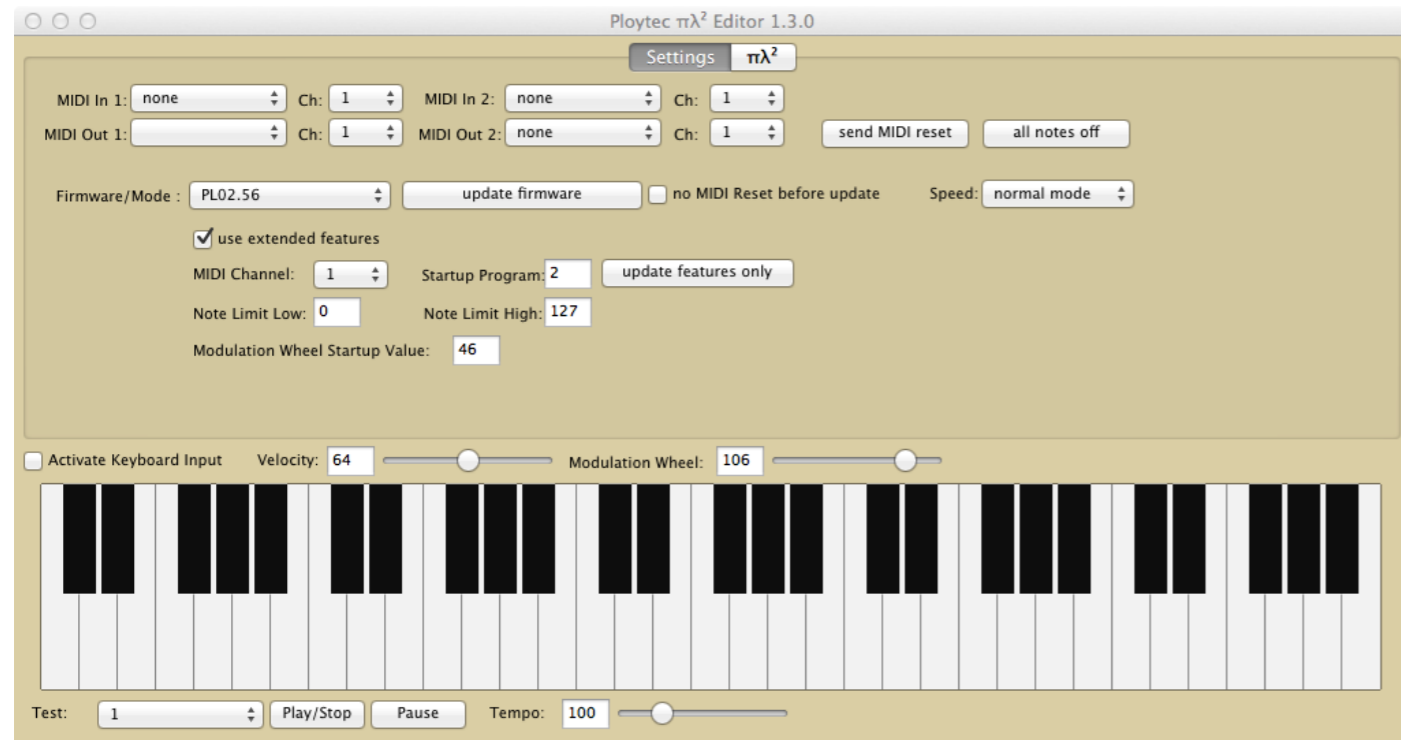
Current consumption:	10mA max.
Output level:	580mV _{RMS (nom.)}
Digital "State Variable Filter":	Samplerate: 125kHz (Waveforms), 50kHz (Bassdrum Mode)
Dimensions:	46.5 x 27.5 x 52.0 [mm] (wxhxd)

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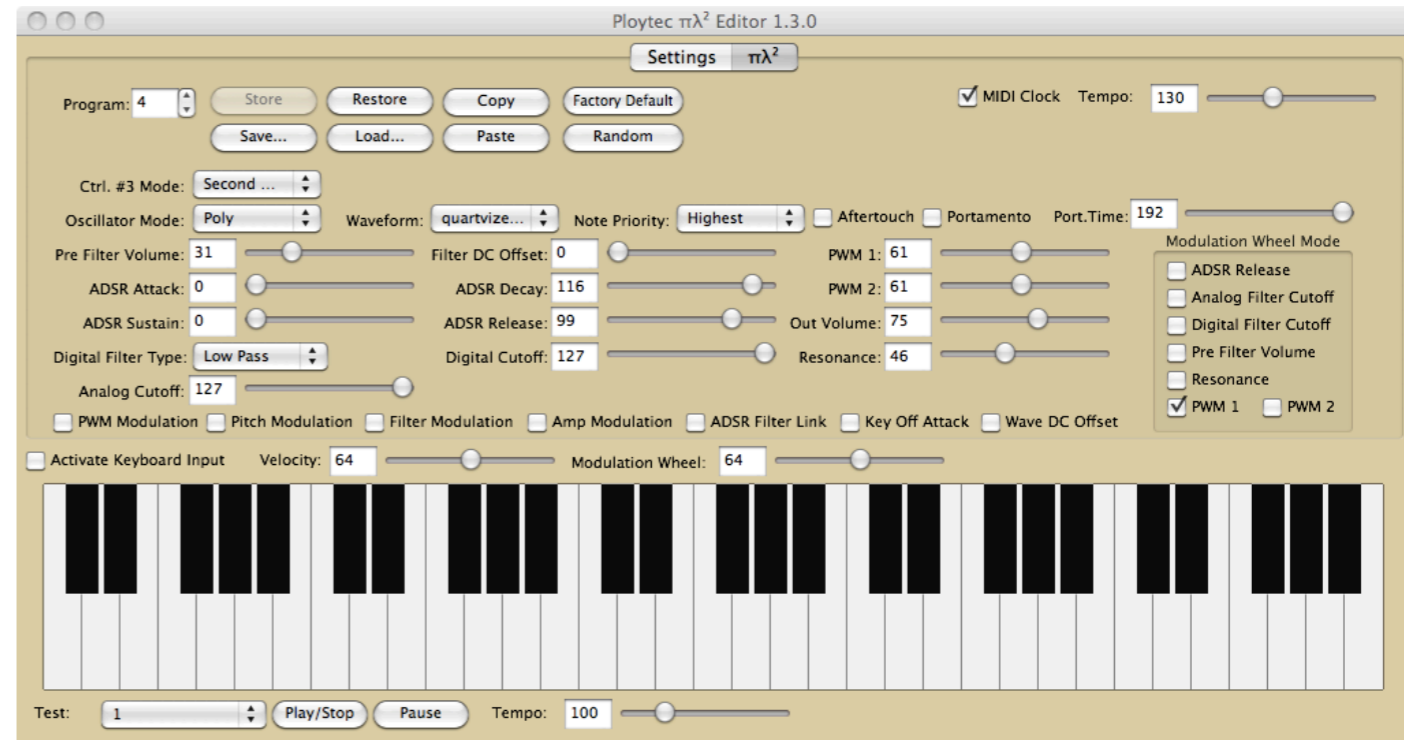
Editor

The editor lets you comfortably edit all PL2 parameters on your Mac or PC. Additionally, it is possible to select, play and even record short demo sequences. Future feature enhancements can be implemented to the PL2 by using the editor's firmware update facility. Because the communication runs through your own MIDI interface it is possible to set the transfer speed in three steps



(fast mode: approx. 3s, normal mode: approx. 7s and save mode: approx. 32s). Reduce the speed if transfer problems occur.

Note: unlike a standard MIDI control change message each program will not be saved automatically when using the editor for switching. Use the dedicated **Save** button here.



MIDI Implementation Chart

[PL2 (PI L SQUARED) duophonic square wave synth]
PL2 MIDI Implementation Chart

Date:01.08.2014

Function	Transmitted	Recognized	Remarks
Basic Default Channel Changed	x	1-16	
Mode Default Messages Altered	x x *****	Mode 3 POLY, MONO x	
Note Number: True Voice	x *****	0-127 0-127	
Velocity Note On Note Off	x x	o 1-127 x	
Aftertouch Key's Ch's	x x	x x	Volume Control
Pitch Bender	x	o	-12<-0->+12 semi, 8 bit resolution *2
	1	x	o Modulation Wheel *3
	2	x	o Breath Control *4
	3	x	o Mode Select (Second/Normal) *15
	5	x	o Portamento Time
	7	x	o Out Volume
Control Change	10 14, 70	x x	o PWM 1 & 2 *5 o Filter Cutoff - Analog

Function	Transmitted	Recognized	Remarks
	15, 71	x	o Filter Resonance - Digital
	16, 72	x	o ADSR Release
	17, 73	x	o ADSR Attack
	18, 74	x	o Digital Filter Cutoff
	19, 91	x	o ADSR Decay
	20, 92	x	o OSC Volume (Pre Filter Volume)
	21, 93	x	o ADSR Sustain
	22, 94	x	o DC Offset (Post Filter)
	23, 95	x	o PWM 2 *6
	24, 75	x	o Waveform *1
Control Change	25, 76	x	o PWM 1
	26, 77	x	o Dual/Detune *1
	27, 78	x	o Dual/Octave *1
	28, 79	x	o Filter Type - Digital *1
	29, 80	x	o Filter Link ADSR *1
	30, 81	x	o Key-Off Attack *1
	31, 82	x	o Modulation Wheel Mode *7
	64	x	o Sustain Hold *1
	65	x	o Portamento *1
	83	x	o DC Offset (Pre Filter) *1
	85	x	o PWM Modulation (LFO) *1
	86	x	o Pitch Modulation (LFO) *1
	87	x	o Filter Modulation (LFO) *1
	88	x	o Amp Modulation (LFO) *1
	89	x	o Note Priority and Aftertouch *8
	120	x	o All Sound Off *1
	123	x	o All Notes Off *1

Function	Transmitted	Recognized	Remarks
Program Change True Number	x *****	o 0-63 0-63	*9
System Exclusive	x	o	*10
System Common			
SongPosition	x	x	
SongSelect	x	x	
Tune	x	o	*11
System Real Time			
Clock Commands	x	o Start	*12 *13
Aux :Local On/Off	x	x	
Mes- :All Notes Off	x	o 1-127	
sages :Active Sense	x	o	
:Reset	x	o	*14

Notes
*1: Switch
*2: Pitch Wheel Change (E0 hex). MSB and bit 0 of LSB used
*3: Effects parameters according to bitpattern table (defined in controller #31, 82)
*4: Overwrites Aftertouch information and vice-versa
*5: Overwrites PWM 1 (controller #25, 76) and PWM 2 (controller #23, #95)
*6: Effective only for waveform 2-4 (controller #24, 75)
*7: Defines modulation wheel routings according to bitpattern table
*8: Controller #89 sets both, Aftertouch (bit 5) and Note Priority (bit6)
*9: 0-31 (program 1-32) is fixed factory set, 32-63 (program 33-64) is user set
*10: Used for future system exclusive firmware updates
*11: Reset to start-up condition
*12: Synchronising LFO clock and ADSR speed. Once linked a losing clock signal will cause a complete system reset!
*13: LFO restart
*14: Reset to start-up condition
*15: Mode Select: 0 = normal mode, 1 = second mode, 2-127 undefined
Mode 1 : OMNI ON, POLY Mode 2 : OMNI ON, MONO o :Yes
Mode 3 : OMNI OFF, POLY Mode 4 : OMNI OFF, MONO x :No